In [ ]:
```
# Neural Netwrok Project
#load mnist dataset from tensorflow keras, handwritten digits with 28*28 pixe
```

In [4]:
```
!pip install opencv-contrib-python
```

```
Collecting opencv-contrib-python
  Downloading opencv_contrib_python-4.7.0.72-cp37-abi3-win_amd64.whl (44.9 M
B)
Requirement already satisfied: numpy>=1.17.3 in c:\users\asus\anaconda3\lib
\site-packages (from opencv-contrib-python) (1.21.5)
Installing collected packages: opencv-contrib-python
Successfully installed opencv-contrib-python-4.7.0.72
```

In [6]:
```
!pip install tensorflow
```

```
2.11->tensorflow-intel==2.11.0->tensorflow) (0.2.8)
Requirement already satisfied: rsa<5,>=3.1.4 in c:\users\asus\anaconda3\l
ib\site-packages (from google-auth<3,>=1.6.3->tensorboard<2.12,>=2.11->te
nsorflow-intel==2.11.0->tensorflow) (4.7.2)
Collecting requests-oauthlib>=0.7.0
  Using cached requests_oauthlib-1.3.1-py2.py3-none-any.whl (23 kB)
Requirement already satisfied: pyasn1<0.5.0,>=0.4.6 in c:\users\asus\anac
onda3\lib\site-packages (from pyasn1-modules>=0.2.1->google-auth<3,>=1.6.
3->tensorboard<2.12,>=2.11->tensorflow-intel==2.11.0->tensorflow) (0.4.8)
Requirement already satisfied: urllib3<1.27,>=1.21.1 in c:\users\asus\ana
conda3\lib\site-packages (from requests<3,>=2.21.0->tensorboard<2.12,>=2.
11->tensorflow-intel==2.11.0->tensorflow) (1.26.9)
Requirement already satisfied: idna<4,>=2.5 in c:\users\asus\anaconda3\li
b\site-packages (from requests<3,>=2.21.0->tensorboard<2.12,>=2.11->tenso
rflow-intel==2.11.0->tensorflow) (3.3)
Requirement already satisfied: charset-normalizer~=2.0.0 in c:\users\asus
\anaconda3\lib\site-packages (from requests<3,>=2.21.0->tensorboard<2.12,
>=2.11->tensorflow-intel==2.11.0->tensorflow) (2.0.4)
Requirement already satisfied: certifi>=2017.4.17 in c:\users\asus\anacon
```

In [7]:
```
import os
import cv2
import numpy as np
import matplotlib.pyplot as plt
import tensorflow as tf
```

In [8]:
```
mnist = tf.keras.datasets.mnist
```

In [9]:
```
(X_train,y_train),(X_test,y_test) = mnist.load_data()
```

```
Downloading data from https://storage.googleapis.com/tensorflow/tf-keras-dat
asets/mnist.npz (https://storage.googleapis.com/tensorflow/tf-keras-dataset
s/mnist.npz)
11490434/11490434 [==============================] - 6s 1us/step
```

In [10]:
```
#normalise the data, we normalising the pixel i.e. the image not class
X_train = tf.keras.utils.normalize(X_train,axis=1)
X_test = tf.keras.utils.normalize(X_test,axis=1)
```

In [12]:
```
#neural network model
model = tf.keras.models.Sequential()
model.add(tf.keras.layers.Flatten(input_shape = (28,28)))
model.add(tf.keras.layers.Dense(128,activation = 'relu'))
model.add(tf.keras.layers.Dense(128,activation = 'relu'))
model.add(tf.keras.layers.Dense(10,activation = 'softmax'))

model.compile(optimizer = "adam",loss="sparse_categorical_crossentropy",metri
```

In [16]:
```
model.fit(X_train,y_train,epochs=3)
```

```
Epoch 1/3
1875/1875 [==============================] - 4s 2ms/step - loss: 0.1057 - ac
curacy: 0.9679
Epoch 2/3
1875/1875 [==============================] - 4s 2ms/step - loss: 0.0719 - ac
curacy: 0.9776
Epoch 3/3
1875/1875 [==============================] - 4s 2ms/step - loss: 0.0533 - ac
curacy: 0.9834
```

Out[16]:
```
<keras.callbacks.History at 0x1e14e8e9a60>
```

In [17]:
```
model.save("handwritten.model")
```

```
WARNING:absl:Found untraced functions such as _update_step_xla while saving
(showing 1 of 1). These functions will not be directly callable after loadin
g.

INFO:tensorflow:Assets written to: handwritten.model\assets

INFO:tensorflow:Assets written to: handwritten.model\assets
```

In [18]:
```
loss,accuracy = model.evaluate(X_test,y_test)
```

```
313/313 [==============================] - 1s 2ms/step - loss: 0.0886 - accu
racy: 0.9726
```

In [19]:
```
print(loss)
```

```
0.0885615274310112
```

In [20]:
```
print(accuracy)
```

```
0.972599983215332
```

In [ ]:
```

```